

LEAG Presentation to PAC

Dr. Samuel Lawrence
Chair, Lunar Exploration Analysis Group

Planetary Advisory Council Meeting
24 September 2019



MEET YOUR LEAG EXECUTIVE COMMITTEE

- Chair: Dr. Samuel Lawrence, NASA Johnson Space Center
- Vice-Chair: Dr. Barbara Cohen, NASA Goddard Space Flight Center
- Vice-Chair: Dr. Brett Denevi, JHUAPL
- Emeritus Chair: Dr. Clive Neal, Notre Dame
- LEAG Director of Operations: Dr. Amy Fagan, Western Carolina University
- Workforce Chair: Dr. Ryan Watkins, Planetary Science Institute
- Surface Operations Chair: Dr. Kelsey Young, NASA Goddard Space Flight Center
- LPI Director: Dr. Louise Prockter, Lunar and Planetary Institute/USRA
- LRO Mission Rep: Dr. Noah Petro, NASA Goddard Space Flight Center
- ARTEMIS Mission Rep: Dr. Jasper Halekas, University of Iowa
- ISRU Expertologist: Jerry Sanders, NASA Johnson Space Center
- Commercial Advisory Board Chair: Kurt Klaus, Lunar and Planetary Institute
- ESA Representative: Dr. James Carpenter, ESA

Ex Officio Members:

- Dr. Sarah Noble, NASA HQ, SMD/PSD
- Dr. Ben Bussey, NASA HQ, SMD/LDEP
- Andy Petro, NASA HQ, STMD
- Greg Schmidt, SSERVI, NASA ARC
- Dr. Jake Bleacher, NASA HQ, HEOMD

A Cohesive Framework for Profound Discovery

- In 2017+2018, LEAG undertook a comprehensive look at the current state of lunar science and exploration



NEXT STEPS ON THE MOON
REPORT OF THE SPECIFIC ACTION TEAM

BACK TO THE MOON
REPORT OF THE 2017 WORKSHOP

REPORT OF THE LUNAR EXPLORATION
ANALYSIS GROUP SPECIAL ACTION TEAM

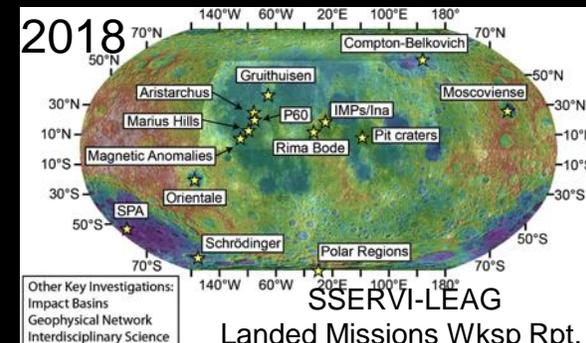


THE MOON
GATEWAY TO THE SOLAR SYSTEM

"PROGRESS IS NOT A SHOT IN THE DARK,
BUT A SERIES OF LOGICAL STEPS."
-ROBERT H. GODDARD



US-LER



2019: Every Journey Has a First Step

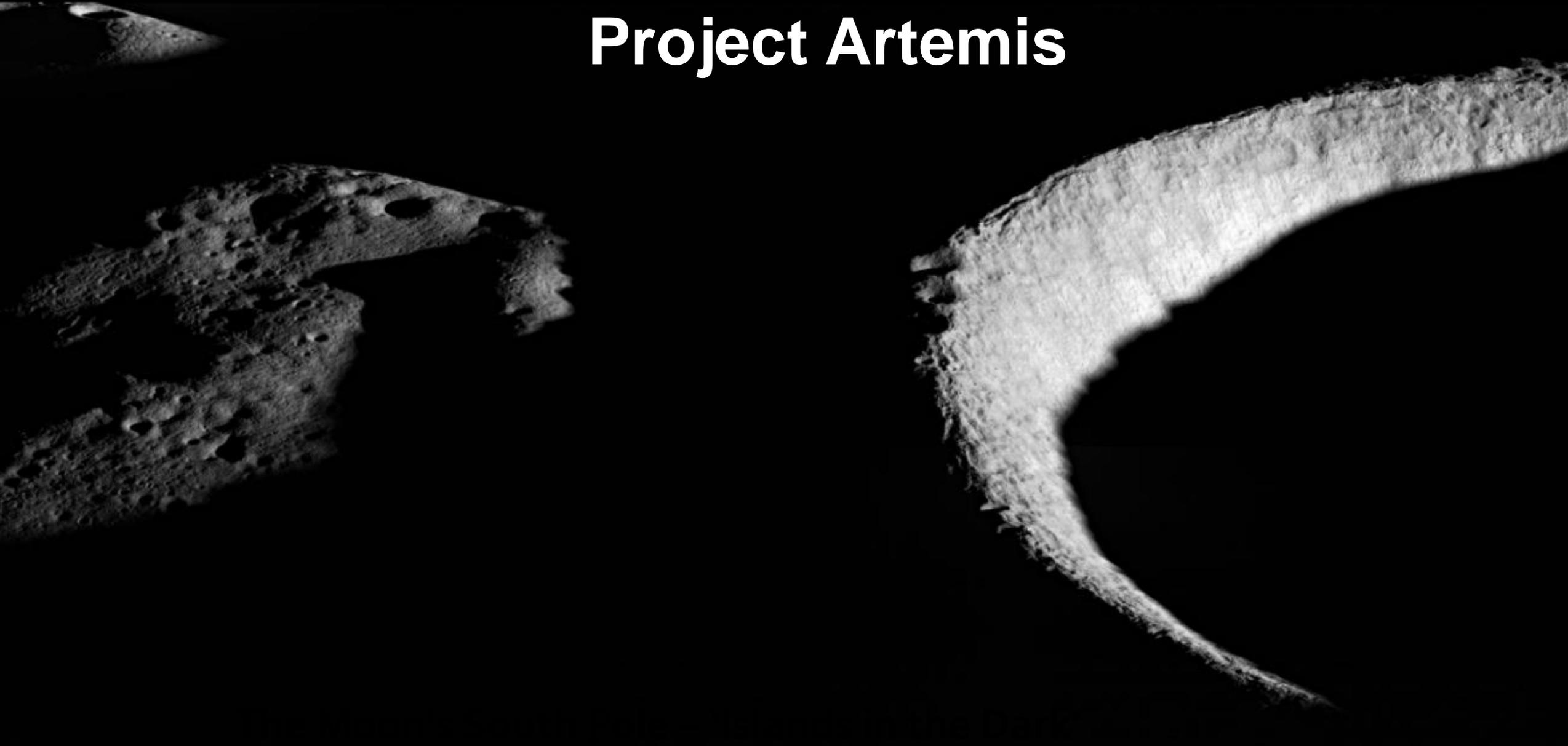
• *We have a fully funded SMD lunar exploration program!!!*

- CLPS providers under contract
- DALI Selections
- LSTIP Selections
- NASA-provided instruments
- New SSERVI Nodes selected
- ANGSA Teams selected
- TrailBlazer SIMPLEX Concept
- Human lunar lander effort underway

LEAG Activities

- Wildly Successful 2018 LEAG meeting!
 - New meeting format!
 - Survive the Night LEAG/SSERVI meeting
 - Strong participation from entire LEAG community – 283 attendees
 - 27 Mission Concepts
- Lunar ISRU 2019
 - July 15-19, USRA HQ, Columbia, MD
 - 200+Attendees
 - Speech by NASA Dep. Admin Morhard
- Astro2020 White Papers

Project Artemis



Dr. Scott Pace has noted that the LEAG Lunar Exploration Roadmap is one of the guiding policy frameworks for Project Artemis!

Lunar South Pole from LRO

Decadal Survey: Six Big Questions

- Generally positive community reception to the “Big Question” concept for organizing the next Decadal
 - Of course, not uniformly positive, some strong feelings about preserving body-centric organization
 - Firm section page limits could help prevent any one question from overwhelming the others
- How do solar systems form and evolve over time, and when did major solar system events happen?
 - Solar system dynamics, bombardment chronology, and observations of nascent extrasolar systems
- How do planetary interiors differentiate and evolve through time, and how are interior processes expressed through surface–atmosphere interactions?
 - Geophysical studies of the lunar interior, volcanic processes, and outgassing
- What processes shape planetary surfaces and how do these surfaces record solar system history?
 - Planetary geology, lunar volatiles, and solar wind/plasma interactions
- How do worlds become habitable, and how is habitability sustained over time?
 - Most relevant to Mars and Ocean Worlds; also includes volatile formation, transport, and delivery: the volatile history of the Earth–Moon system may be preserved on the Moon
- Why are the climates of planetary bodies so diverse, and how did they evolve over time?
 - Atmospheres, the history of the Sun, aspects of habitability, parts of Venus-related science, and other key topics
- Is there life elsewhere in the solar system?
 - Astrobiology as it relates to Ocean Worlds, Mars exploration, studies of meteorites, and other key topics

Another Key Question

- What are the resources and hazards of the Solar System for human exploration?
 - This question would encompass locating resources on the Moon, small bodies, the Jovian system, and Mars (i.e., extraterrestrial economic geology), and identification of potential hazards (e.g., radiation) to human exploration and settlement of the Solar System
 - Similar to planetary defense, planetary science is well poised to answer this question
 - Currently, resource potential is “bonus” science, same with radiation hazards
 - Worth considering some form of this question in order to increase interconnectivity and examine priorities for an area on the boundary of planetary science and human exploration
- Previous decadal surveys have taken a generally hands-off approach to human space exploration, but a couple of important things to note:
 - Human exploration is one avenue for NASA to implement decadal science priorities
 - Decadal should refrain from “value judgements” about the role of human exploration

On new implementation opportunities

- CAPS is discussing “New Topic” areas, including commercial entities, public/private partnerships, philanthropic spaceflight
- LEAG feels that these are not “new topics” for the decadal panels to consider but rather new modes of acquisition and new opportunities for implementation
- Decadal provides science priorities → NASA implements them using all the tools at their disposal, which include R&A, competed and directed SMD missions, HEO partnerships, pay-for-data or pay-for-delivery commercial models, public/private partnerships, philanthropic spaceflight
- Could be value-added for the decadal to spend a chapter highlighting how science priorities (from all AGs, not just lunar! – e.g. Mars, planetary defense, etc.) might be mapped to emerging opportunities. The makeup of such a panel could be augmented with expertise in emerging opportunities.

On the question of New Frontiers

- The LEAG community consensus is that New Frontiers mission priorities should be determined by the decadal process, and updated in a mid-decadal review if necessary
- The decadal process makes a thorough attempt to determine community priorities. If left open:
 - Individual managing institutions would become the gatekeepers of what is submitted
 - No guarantee that NF reviewers will have the same broad, informed perspective
- **Related: Numerous lunar submissions to the Planetary Mission Concept Studies**
 - Community still unclear on prioritization of selections, how/if further concept studies will flow from white paper input

The banner features a blue background with a large, detailed image of the moon on the left. On the right, there is a silhouette of a woman in a dress holding a bow and arrow, aiming towards the left. The text 'LEAG' is prominently displayed in the center in a large, white, sans-serif font. Below it, the full name of the group is written in a smaller, white, sans-serif font. A dotted line separates the name from the date and location information. The date and location are also in a white, sans-serif font.

LEAG

Annual Meeting of the Lunar
Exploration Analysis Group

October 28–30, 2019
Washington D.C.

- 2019 LEAG Meeting will be at the Washington Hilton, Washington, D. C.
- Day 1: Preparing for the Next Planetary Decadal Survey
- Day 2+3: Planning for future Human Lunar Exploration (Project Artemis)
- *The confluence of preparing for the next decadal survey and Artemis makes this an unusually important LEAG meeting*